

REMARKS

Claims 1-40 are pending in the application. Claims 20-40 are withdrawn from consideration as being directed to non-elected inventions. In the Final Office Action of April 22, 2004, the Examiner made the following disposition:

- A.) Objected to claims 1-19.
- B.) Rejected claims 1-19 under 35 U.S.C. §112, first paragraph.
- C.) Rejected claims 1-19 under 35 U.S.C. §112, second paragraph.
- D.) Rejected claims 1, 2, 4-6, 9-11, 13-15, 18 and 19 under 35 U.S.C. §102(b) as being anticipated by *Toyoda et al.*
- E.) Rejected claims 3, 7, 8, 12, 16 and 17 under 35 U.S.C. §103(a) as being unpatentable over *Toyoda et al.* in view of *Kubokoya*.

Applicants respectfully traverse the rejections and address the Examiner's disposition as follows:

A.) Objection to claims 1-19:

Claims 1 and 10 have been amended as per the Examiner's request to overcome the objection.

Claims 2-9 and 11-19 depend directly or indirectly from claim 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the objection has been overcome and request that it be withdrawn.

B.) Rejection of claims 1-19 under 35 U.S.C. §112, first paragraph:

Claims 1 and 10 have been amended as per the Examiner's request to overcome the rejection. Specifically, claims 1 and 10 have been amended to clarify that the second conductive layer is formed on a surface of the connection pillar opposite the first conductive layer. Support for this can be found in Figures 9 and 10 and their accompanying description in the specification.

Claims 2-9 and 11-19 depend directly or indirectly from claim 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the objection has been overcome and request that it be withdrawn.

C.) Rejection of claims 1-19 under 35 U.S.C. §112, second paragraph:

Claims 1 and 10 have been amended as per the Examiner's request to overcome the rejection.

Claims 2-9 and 11-19 depend directly or indirectly from claim 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the objection has been overcome and request that it be withdrawn.

D.) Rejection of claims 1, 2, 4-6, 9-11, 13-15, 18 and 19 under 35 U.S.C. §102(b) as being anticipated by *Toyoda et al.*:

Applicants respectfully disagree with the rejection.

Referring to Applicants' Figures 8 and 10 as an illustrative example, Applicants' independent claims 1 and 10, each as amended, each claim a semiconductor device in which a second conductive layer 7 is connected through a connection pillar 5 to a first conductive layer 3 embedded in a groove 2a formed in an insulation film 2. The connection pillar 5 is formed directly on a surface of the first conductive layer 3, and the second conductive layer 7 is formed on an opposite surface of the connection pillar 5. The connection pillar 5 exhibits a crystallographical alignment to the first conductive layer 3 and a mechanical strength effected by being grown from the surface of the first conductive layer 3 without use of a growth guide at a direction of a width of the first conductive layer 3 such that the connection pillar 5 has a width that is aligned to the width of the first conductive layer 3 without use of the growth guide.

As shown in Figure 8, for example, the connection pillar 5 is grown vertically from the surface of the first conductive layer 3 without the use of a growth guide (such as a mask or via hole) located at the sides of the width of the connection pillar 5. When the connection pillar 5 is grown, it self-aligns to the width of the first conductive layer 3 without requiring a growth guide at its sides to assist with aligning to the width of the first conductive layer 3.

As discussed in Applicants' specification, since Applicants' claimed connection pillar 5 is grown without the use of a growth guide, the claimed connection pillar 5 exhibits characteristics of improved crystallographical alignment to the first conductive layer 3 and improved mechanical strength, compared to the characteristics exhibited by typical connection pillars that are formed using masks or via holes. (*See, e.g.*, Page 8, line 20 - page 9, line 5).

This is clearly unlike *Toyoda*, which fails to disclose or even suggest Applicants' claimed connection pillar. Referring to *Toyoda* Figures 7 and 8, *Toyoda* discloses a first conductive layer 2 formed in a recess of a first insulating film 1. A second insulating film 3 is formed on the first insulating film 1 and has a hole 9 therethrough. A second conductive layer 7a is formed over the second insulating film 3 and into the hole 9 of the second insulating film. Thus, the second conductive layer 7a is a single layer that exists on top of the second insulating film 3 and in the hole 9. Accordingly, the hole acts as a mold for each side of the second conductive layer 7a that is formed in the hole.

Thus, unlike Applicants' claims 1 and 10, *Toyoda's* second conductive layer 7a is not formed on a surface of a connection pillar, but is instead a same layer as its pillar. For at least this reason, *Toyoda* fails to anticipate Applicants' claims 1 and 10.

Further, the portion of *Toyoda's* second conductive layer 7a that is formed in *Toyoda's* hole 9 could not exhibit a crystallographical alignment or mechanical strength as exhibited by Applicants' claimed connection pillar, because *Toyoda's* second conductive layer 7a is not effected by being grown from the surface of *Toyoda's* first conductive layer 2 without use of a growth guide. As clearly shown in *Toyoda* Figure 7, *Toyoda* uses the hole 9 as a mold (or growth guide) to form its second conductive layer 7a in the hole 9.

Thus, *Toyoda's* second conductive layer 7a that is formed in the hole is similar to conventional connection pillars as described in Applicants' Background of the Invention. *Toyoda's* second conductive layer 7a is clearly formed within the via hole 9 of *Toyoda's* second insulating layer 3. Thus, like other conventional devices, *Toyoda's* device does not exhibit the characteristics of a connection pillar that is grown without use of a growth guide. Namely, unlike Applicants' claimed connection pillar, *Toyoda's* connection pillar does exhibit a crystallographical alignment to the first conductive layer and improved mechanical strength.

Therefore, *Toyoda* fails to disclose or even suggest claims 1 and 10.

Claims 2, 4-6, 9, 11, 13-15, 18 and 19 depend directly or indirectly from claim 1 and are therefore allowable for at least the same reasons that claim 1 is allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

E.) Rejection of claims 3, 7, 8, 12, 16 and 17 under 35 U.S.C. §103(a) as being unpatentable over *Toyoda et al.* in view of *Kubokoya*:

Applicants respectfully disagree with the rejection.

Applicants' independent claims 1 and 10 are allowable over *Toyoda* as discussed above. *Toyoda* in view of *Kubokoya* still fails to disclose or suggest Applicants' claimed connection pillar. Referring to *Kubokoya* Figure 1, *Kubokoya* discloses a first conductive layer 103. A second conductive layer 105 is formed such that a portion of the second conductive layer 105 dips into a recess (similar to a wide via hole) and contacts the first conductive layer 103.

Thus, unlike Applicants' claim 1, *Kubokoya* does not even teach a connection pillar that is distinct from its second conductive layer. *Kubokoya* teaches no connection pillar. *Kubokoya* merely teaches that its second conductive layer 105 dips down to contact its first conductive layer 103, with no connection pillar therebetween. Accordingly, *Kubokoya* fails to disclose or even suggest Applicants' claims 1 and 10.

Further, as *Kubokoya* does not disclose a distinct connection pillar, *Kubokoya* could not disclose a connection pillar having Applicants' claimed characteristics effected by being grown from a surface of a first conductive layer without use of a growth guide at the width of the first conductive layer. As discussed above, *Kubokoya* fails to even disclose a distinct connection pillar. Further, the portion of *Kubokoya's* second conductive layer 105, which dips into a wide via hole to contact the first conductive layer 103, is clearly formed using the sides of the wide via hole. Thus, like other conventional devices, *Kubokoya's* device could not exhibit the characteristics of a connection pillar that is grown without use of a growth guide.

Therefore, *Toyoda* in view of *Kubokoya* still fails to disclose or even suggest claims 1 and 10.

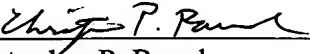
Claims 3, 7, 8, 12, 16 and 17 depend directly or indirectly from claims 1 or 10 and are therefore allowable for at least the same reasons that claims 1 and 10 are allowable.

Applicants respectfully submit the rejection has been overcome and request that it be withdrawn.

CONCLUSION

In view of the foregoing, it is submitted that claims 1-19 are patentable. It is therefore submitted that the application is in condition for allowance. Notice to that effect is respectfully requested.

Respectfully submitted,

 (Reg. No. 45,034)
Christopher P. Rauch
SONNENSCHNEIN, NATH & ROSENTHAL LLP
P.O. Box #061080
Wacker Drive Station - Sears Tower
Chicago, IL 60606-1080
Telephone 312/876-2606
Customer #26263
Attorneys for Applicant(s)

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited as First Class Mail in an envelope addressed to Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on May 25, 2004.



Christopher P. Rauch (Reg. No. 45,034)
Christopher P. Rauch